

## Europa Kinetic Ice Penetrator (EKIP)

Completed Technology Project (2015 - 2018)



## Project Introduction

The goal of the proposed work is to validate an initial design for a Europa penetrator that can withstand the high g load associated with the expected hypervelocity impact and enable post impact telemetry data. The proposed system would consist of a two-stage penetrator entry. The first stage would have the hard impact into the solid ice. Any deorbiting motors would be attached to the lead stage and add to the total mass involved in the initial impact. The second stage which carried the necessary electronics, would separate prior to impact from lead section. Because of the initial impact, this 2nd stage penetrator will experience less deformation and achieve greater penetration. As a result the mass of a two-stage system could be in fact less than a single stage system because less reinforcing will be required. To validate the system the proposed work will include (1) RAM accelerator studies to quantify ice penetration and changes in the property of the ice including subsurface fracturing as a function of shape of the projectile, temperature of the ice, and a 2nd impact; (2) calibrate a simulation model with these results to identify simulant material that will behave in a similar fashion as ice at the proposed speeds and then use these simulations to predict the behavior of the full size penetrator system against the simulant material; (3) field test a full size prototype based on the simulations in the high speed ( $< 1$  km/s) regime but modified to take into account differences associated with the hypervelocity impact regime and (4) undertake a preliminary design for the survivability of key electronic components from the impact and their continued operation in the low temperatures of Europa.

## Anticipated Benefits

The goal of the work is to validate an initial design for a Europa penetrator that can withstand the high g load associated with the expected hypervelocity impact and enable post impact telemetry data.



Europa Kinetic Ice Penetrator

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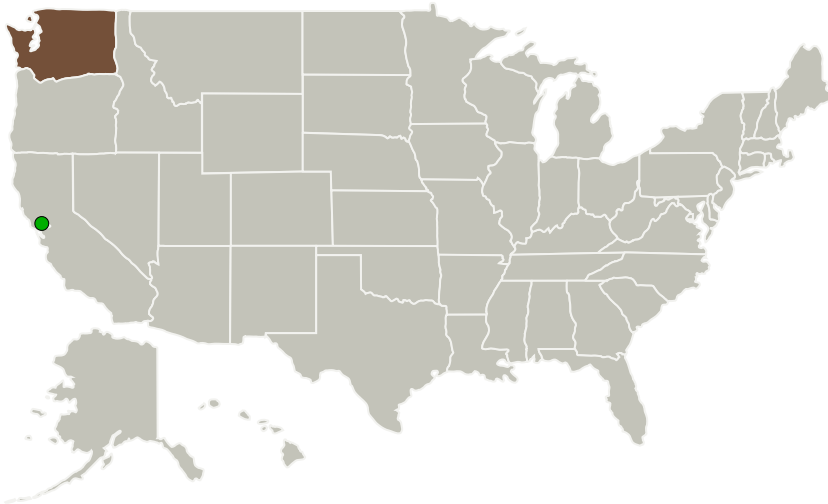
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
University of Washington-Seattle Campus(UW)	Lead Organization	Academia Alaska Native and Native Hawaiian Serving Institutions (ANNH), Asian American Native American Pacific Islander (AANAPISI)	Seattle, Washington
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

## Primary U.S. Work Locations

Washington

## Project Website:

<https://www.nasa.gov/strg#.VQb6T0jJzyE>

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

University of Washington-Seattle Campus (UW)

**Responsible Program:**

Space Technology Research Grants

## Project Management

**Program Director:**

Claudia M Meyer

**Program Manager:**

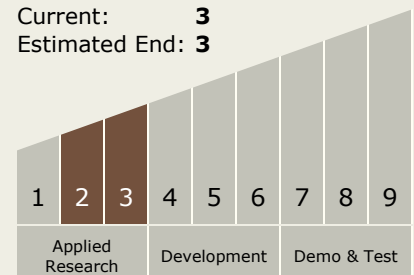
Hung D Nguyen

**Principal Investigator:**

Robert M Winglee

## Technology Maturity (TRL)

Start: 2  
Current: 3  
Estimated End: 3



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## Technology Areas

### Primary:

- TX01 Propulsion Systems
  - └ TX01.3 Aero Propulsion
    - └ TX01.3.11 Engine Icing

## Target Destination

Others Inside the Solar System